Wetting Topology and Molecular Ordering of Alkanes at Solid/Vapor Interfaces: Rolling Hills, Surface Freezing, and Eggs, Sunny-Side Up

H. Schollmeyer, A. Holzwarth, and H. Riegler
MPI fuer Kolloid- und Grenzflaechenforschung
Max-Planck-Campus, Haus 2
14476 Golm/Potsdam, Germany

Long-chain alkanes (16 to 50 C-atoms) show interesting wetting topologies and molecular orderings at SiO_2/air interfaces. Well above the bulk melting temperature one observes a (nearly) complete wetting film of liquid alkane with a “rolling hill” topology. Droplets with very small contact angles (less than one degree) coexist with a film of liquid alkane of about 16 nm thickness. In a temperature range between the bulk melting temperature and several degrees above, droplets of liquid alkane (contact angle of several degrees) coexist with (on top of) an alkane monolayer (“surface freezing”). The thickness of the alkane monolayer scales with the all-trans length of the alkane molecules: the molecules are oriented upright and densely packed. If the amount of alkane which is spread on the surface is not sufficient for one complete monolayer, the alkanes still orient themselves upright in a condensed state. They form dendritic and/or seaweed-like domains with lateral dimensions of several 100 microns. Below the bulk melting temperature the condensed monolayer remains unchanged. The alkane droplets freeze into amorphous/polycrystalline pieces of bulk (frozen droplets) which are distributed on top of the monolayer. If the temperature is kept for some time close to, but below the bulk melting temperature, these frozen droplets can be annealed. They form mesa-shaped islands consisting of stacks of alkane lamella oriented parallel to the interface. Often one finds the rest of the original frozen droplet on top ín the center of the islands (“eggs, sunny side up”).

Alkanes are simple molecules and can well be used as model system for basic wetting studies. We are investigating how the wetting topologies and wetting kinetics are correlated to the molecular ordering and what forces influence them. Experiments with alkane mixtures, temperature gradients, and structured substrate surfaces are used to probe general questions on energy dissipation during wetting/dewetting, on two-dimensional directional solidification and on the influence of confinement on the wetting properties.

C. Merkl, T. Pfohl, and H. Riegler *Phys. Rev. Lett.* **79,** 4625 (1997).

A. Holzwarth, S. Leporatti, and H. Riegler *submitted* (1999).